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Wireless Biometric Data Acquisition System

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Abstract – This paper aims at creating a system that is capable of transmitting biometric data wirelessly over space. Specifically, it will be applied to measuring signals from the body, and sending it over air to a central processing unit, located elsewhere.

Keywords – biometric, telemetry, data acquisition, ECG, transmitter, receiver, LabVIEW, JAVA

I. INTRODUCTION

While the move towards the digital era is being accelerated every hour, biometrics technologies have begun to affect people's daily life more and more. Biometrics technologies verify identity through characteristics such as fingerprints, faces, irises, retinal patterns, palm prints, voice, hand-written signatures, and so on.

Biometric personal authentication uses data taken from measurements. Such data is unique to the individual and remains so throughout one's life.

A typical usage scenario :

In a hospital, where multiple patients whose ECGs are to be monitored, but there is only one monitoring/processing facility is available. In this case, there are multiple ECGs electrode sets available, one for each patient. This is connected to its respective transmitter and each transmitter has a unique ID/channel number. At the central processing room, the doctor/staff selects the ID/channel number through a switch, and then sees the reading directly on the monitor. This paper enables remote monitoring and quick switching between different patients, without having to physically change electrodes or have separate ECG machines for each patient.

II. DATA ACQUISITION SYSTEM

Data acquisition is the process of sampling signals that measure real world physical conditions and converting the resulting samples into digital numeric values that can be manipulated by a computer. Data acquisition systems (abbreviated with the acronym DAS or DAQ) typically convert analog waveforms into digital values for processing. The components of data acquisition systems include:

- Sensors that convert physical parameters to electrical signals.
- Signal conditioning circuitry to convert sensor signals into a form that can be converted to digital values.
- Analog-to-digital converters, which convert conditioned sensor signals to digital values.

Data acquisition applications are controlled by software programs developed using various general purpose programming languages such as BASIC, C, Fortran, Java, Lisp, Pascal.

The purpose of data acquisition is to measure an electrical or physical phenomenon such as voltage, current, temperature, pressure, or sound. PC-based data acquisition uses a combination of modular hardware, application software, and a computer to take measurements. While each data acquisition system is defined by its application requirements, every system shares a common goal of acquiring, analyzing, and presenting information. Data acquisition systems incorporate signals, sensors, actuators, signal conditioning, data acquisition devices, and application software.

III. SYSTEM BLOCK DIAGRAM

The complete block diagram is shown in fig. 1. There are two main blocks in the system - the transmitter and the receiver systems. The transmitter system obtains electrical signals from the patient or a transducer connected to a patient, convert them to a suitable form (serial digital data) for transmitting over air.

The receiving system will receive the data, check for any errors in transmission, and then convert it back to a signal identical to that obtained directly from the patient. This data is fed to the ECG processing machine/monitor which then prints the ECG waveforms. Display and recording devices are usually a computer with a program to present the data in the form of a graph.

Signals may be digital or analog depending on the transducer used. Signal conditioning may be necessary if the signal from the transducer is not suitable for the DAQ hardware being used. The signal may need to be amplified, filtered or demodulated. Various other examples of

signal conditioning might be bridge completion, providing current or voltage excitation to the sensor, isolation and linearization. For transmission purposes, single ended analog signals, which are more susceptible to noise can be converted to differential signals. Once digitized, the signal can be encoded to reduce and correct transmission errors.

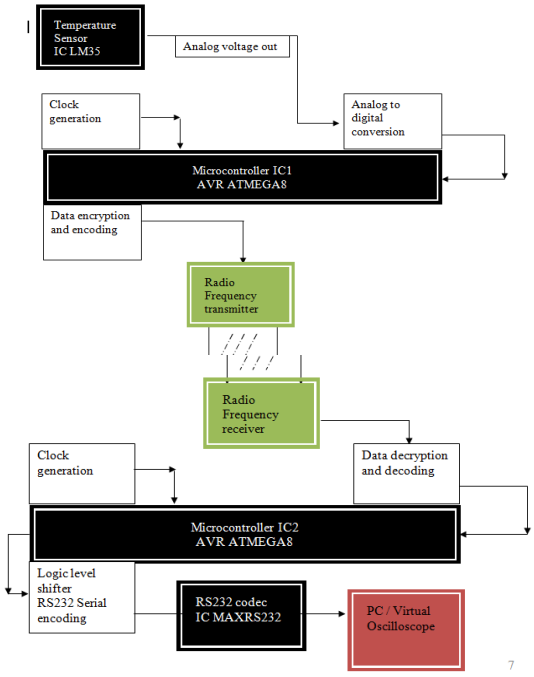

Fig. 1 block diagram

IV. WORKING MODEL

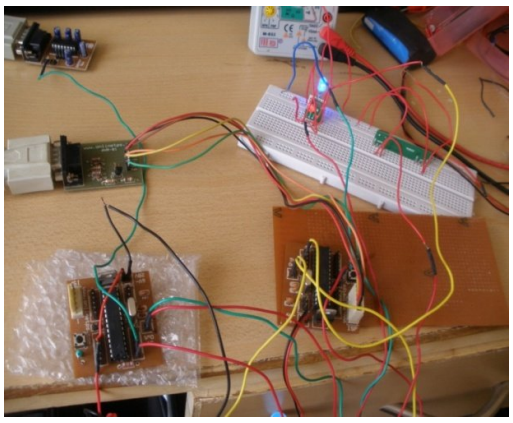

Fig. 2. Hardware setup

- RS232 module is programmed to send biometric information to a PC.
- The signals from RS232 are represented by voltage levels with respect to a system common (power / logic ground).
- RS232 is widely used through the industry.

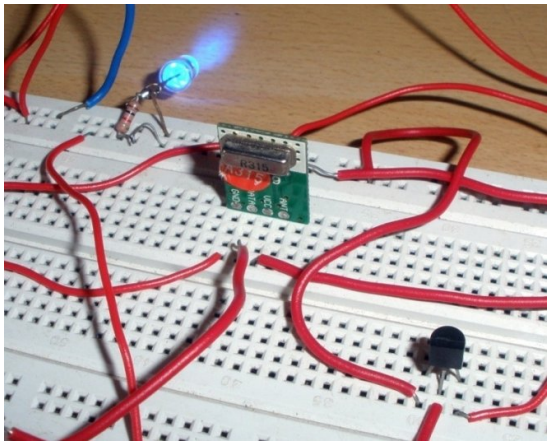

Fig 3. Working model

V. DISPLAY AND STORAGE OF DATA – LABVIEW

The data acquired from the receiving end can be transferred to a computer a serial port (com ports). In the following example we have transmitted data from a temperature sensor to a computer and displayed and stored it using a LabView application. Some of the salient features to the program are:

- Knob and digital control to adjust the time period between collection of data (1s – 60s)
- Graph to plot data recorded against time
- Digital display to present current data value.
- Numeric controls and LEDs to provide and indicate boundary conditions
- File browser to provide path and filename to save the data as spreadsheet for future reference.
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LabView Front Panel

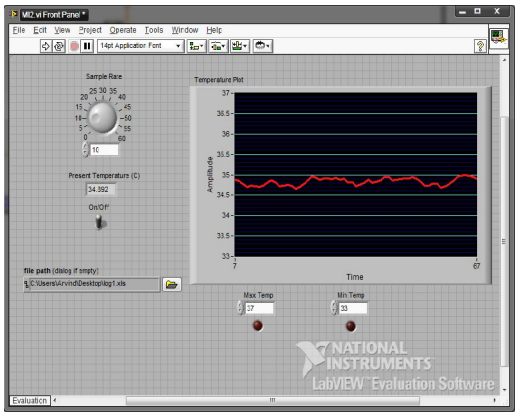

Fig 4. LabView Front Panel

VI. ADVANTAGES

The advantage of storing the biometric data in the database is based on the inherent advantage presented by database systems: centralized, accurate, highly secure, reliable and organized data, easy access to insert, update and retrieve biometric data. Access to the biometric dataset: distribution using CDs, DVDs, download via Internet or registration and other types of access granted to the database.

VI. APPLICATIONS

- Acquisition of data from many patients simultaneously
- Display of real time data in graphical form
- Storage of data for future reference
- Cost cutting by using one display unit to show data from multiple patients eg. ECG
- Many other biometric data can also be processed i.e. Face images, Fingerprint images, Hand geometry images, Palmprint images, Iris images, Voice sound, Soft biometrics (weight and height).

VII. CONCLUSIONS

In a hospital with many patients, communication of critical biometric data is of prime importance. The efficiency of this communication can define the difference between life and death. Wireless technology can help to extend the reach of medical services beyond the boundaries of conventional infrastructure. We have designed and constructed a device to wirelessly communicate conventionally recorded biometric data, display it as graphs, charts, tables and record it for future reference. the device can transmit almost any electrical biometric data obtained either directly from the patient or through a transducer attached to the patient. The program at the receiving end can be modified to include conditions which specify tolerance limits for critical data beyond which audio/visual notifications will be provided to the doctors. Thus the efficiency of patient care, monitoring, analysis, diagnosis and treatment can be drastically improved.

VII. ACKNOWLEDGEMENT

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